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(58) Field of Search
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Other: ONLINE DATABASES: EPODOC, JAPIO, WPI

(54) Abstract Title
Improvements in or relating to a safety-belt buckle

(57) The seat belt buckle has a channel (1) on which there is pivotally mounted a latch (26) a plate (51) is connected to the latch and carries an arm (55) which terminates with a magnet housing (56) carrying magnets (57, 58). A second housing (71) is provided which is connected to the channel and which contains a hall effect sensor (80). The described plate and housing may be snap-fitted to the components of an existing buckle to provide a sensitive hall effect sensor to determine the presence or absence of a tongue within the buckle.

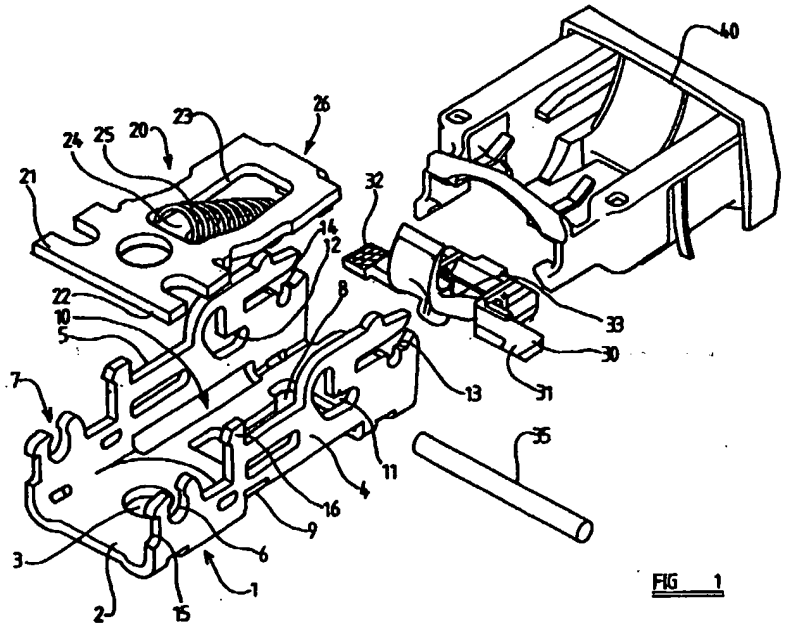

FIG 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

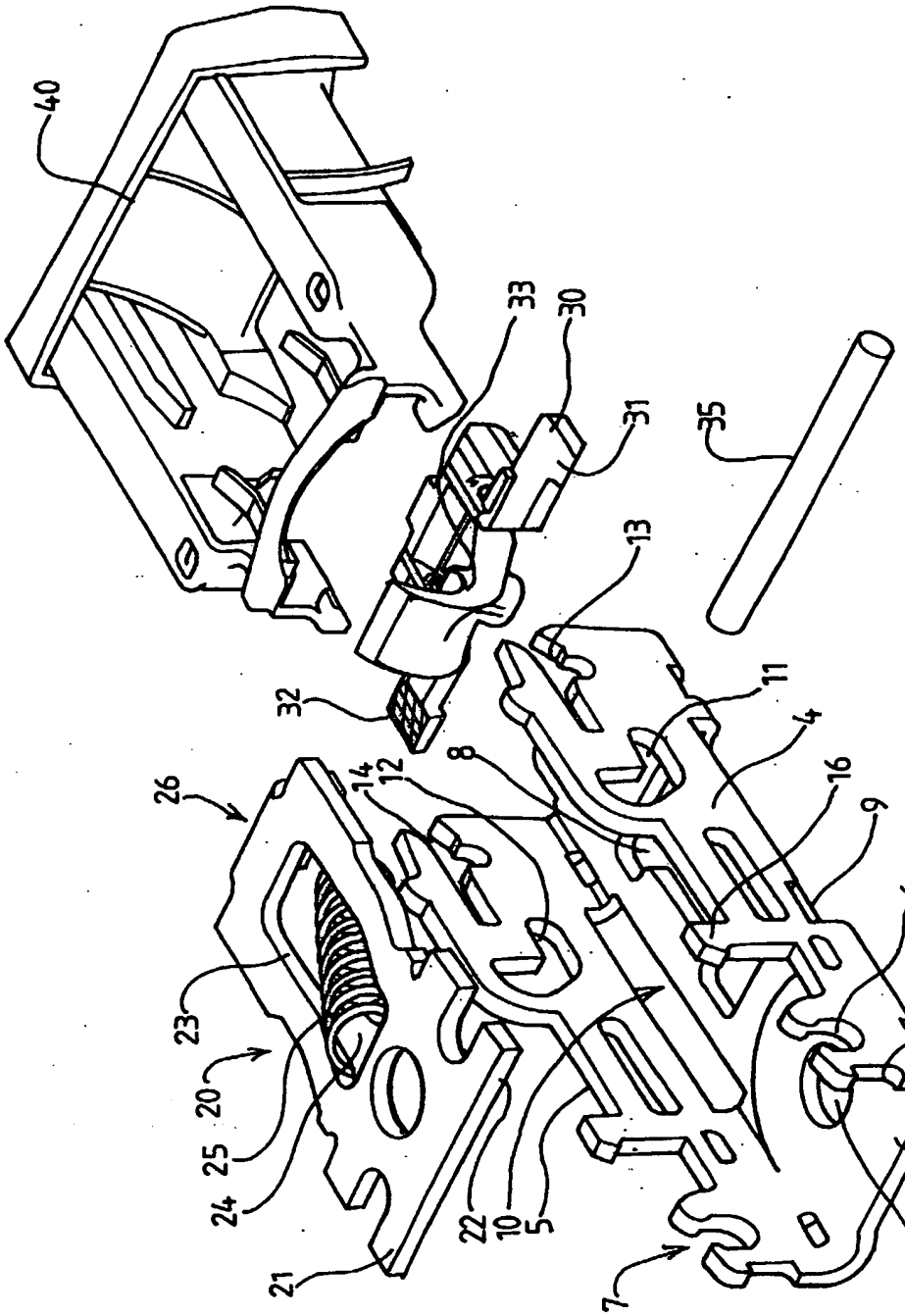
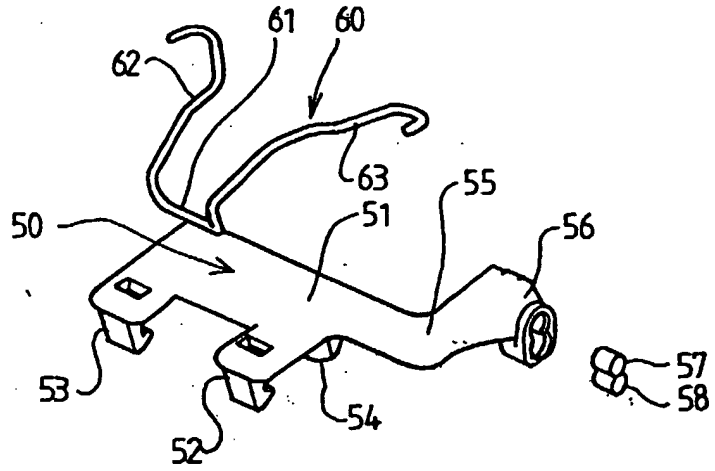


FIG 1



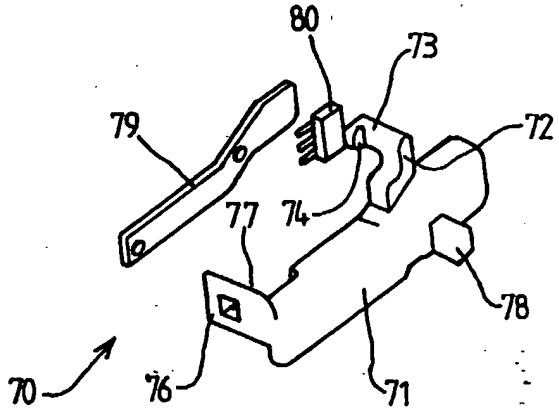


FIG 2

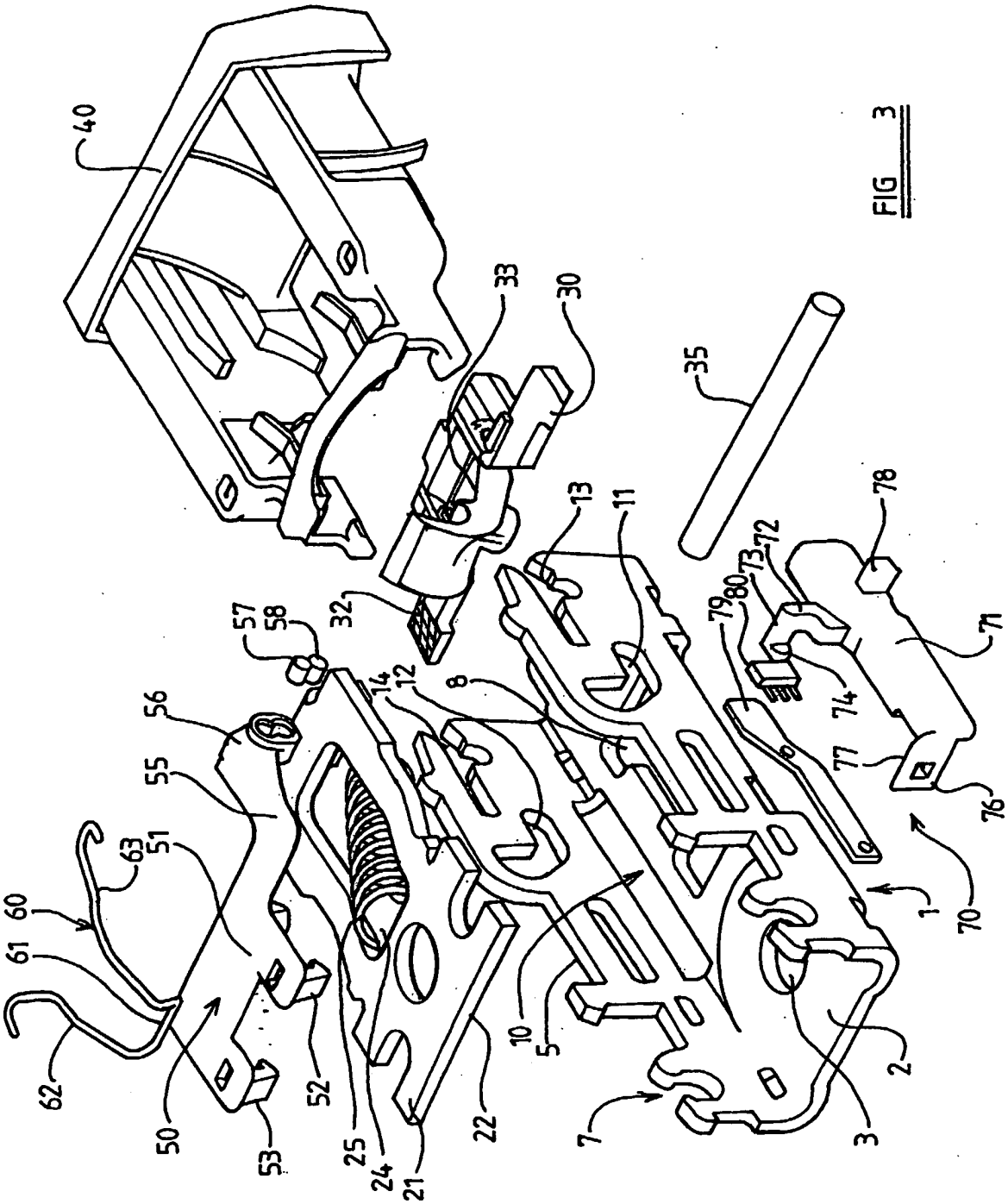

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FIG 3

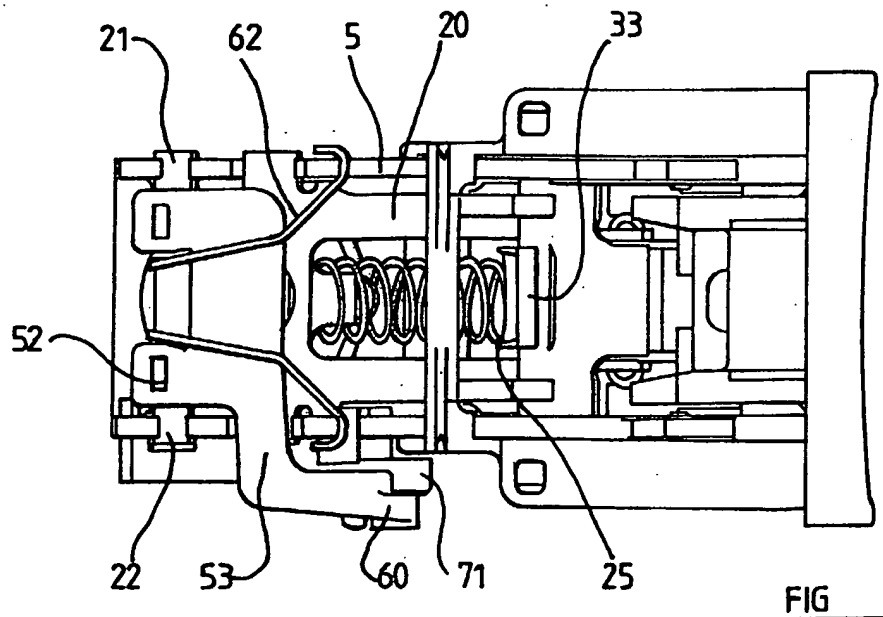

FIG 4

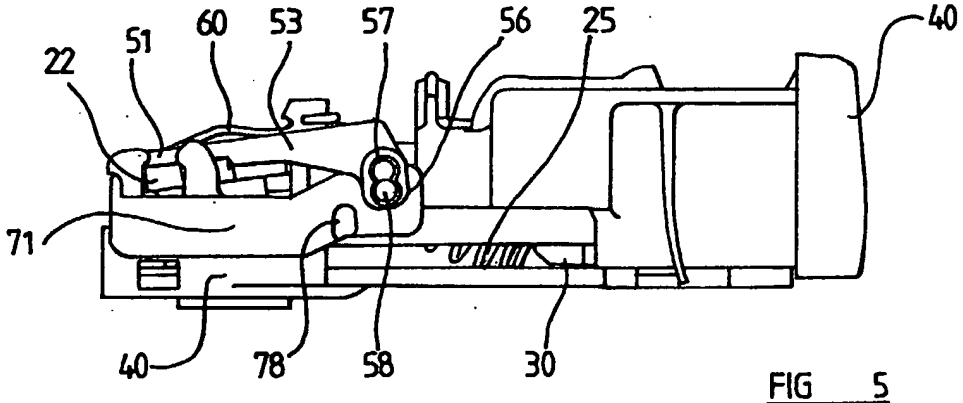

FIG 5

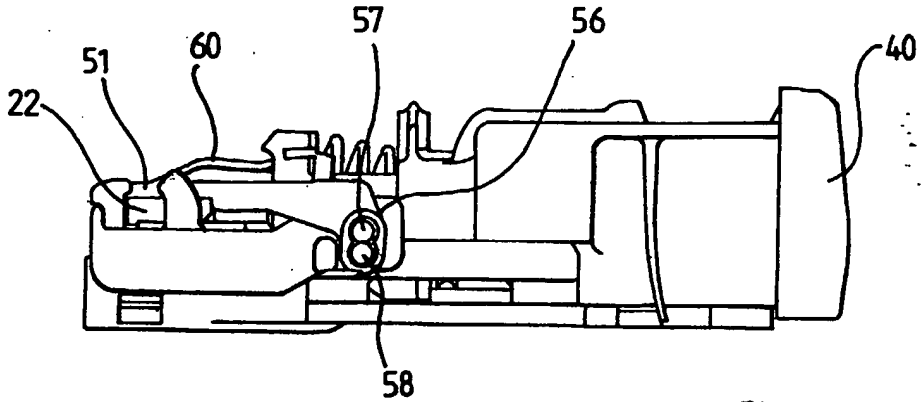

FIG 6

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PATENTS ACT 1977

P16224GB-NF/jsd

DESCRIPTION OF INVENTION

"IMPROVEMENTS IN OR RELATING TO A SAFETY-BELT BUCKLE"

THE PRESENT INVENTION relates to a safety-belt buckle, and more particularly relates to a safety-belt buckle for use in a motor vehicle.

A conventional safety-belt buckle comprises a housing having an opening therein into which a tongue, mounted on part of a safety-belt arrangement, may be inserted. The interior of the housing contains a locking or retaining arrangement which engages the tongue to hold the tongue within the buckle. Typically a push-button is provided which can be manually actuated to release the tongue so that the tongue is then ejected from the housing.

It has been proposed previously to provide a sensor to sense when the tongue is retained within the housing of the buckle. In some cases a signal from the sensor controls a warning light, which can serve to indicate that a safety-belt has not been buckled appropriately. In other circumstances the sensor may provide a signal which, in the event that an accident should arise, may modify or control the deployment of a safety device such as, for example, an air-bag. Thus the air-bag may be deployed in one manner if the seat-belt is buckled and in another, different manner if the seat-belt is not buckled.

Various types of sensor have been proposed previously for use in connection with a safety-belt buckle. It has, for example, been proposed to utilise a micro-switch, but this has some disadvantages as the switch includes moving parts and may thus, over the course of time, suffer from wear or become damaged.

It has been proposed (see, for example, EP-A-0 893 314) to provide a sensor which incorporates a Hall effect device, and an associated magnet. In the arrangement disclosed in this prior Specification, a Hall effect device is provided which is exposed to a magnetic field generated by a magnet whenever the tongue of a seat-belt is not retained within the buckle. However, when the tongue of a seat-belt is inserted into the buckle, part of an armature is moved to a position in which it is located between the magnet and the Hall effect device. Another part of the armature is moved to a position very close to the pole of the magnet which is directed away from the Hall effect device. The consequence of this is that the Hall effect device is then subjected to magnetism of an opposite polarity.

The armature is relatively bulky, and the output signal that may be generated by the Hall effect sensor is of limited strength, because the variation in flux density is not very large.

The present invention seeks to provide an improved buckle incorporating a sensor to sense whether a tongue, associated with the safety-belt is, or is not, retained within the buckle housing.

According to this invention there is provided a seat-belt buckle incorporating a sensor to detect the presence or absence of a tongue retained

within the buckle, the buckle comprising a channel having a base and upstanding side-walls, and a latch-plate mounted for pivotal movement relative to the channel between a latching position and a release position, the latch-plate carrying an arm which extends laterally beyond one side-wall of the channel, and which carries a magnet housing containing at least one magnet, the channel being provided with a Hall effect sensor unit located adjacent the said side-wall, the arrangement being such that the magnet moves relative to the Hall effect sensor as the latch moves from the latching position to the release position.

Preferably the magnet housing contains two magnets, the magnets being located adjacent each other and each having one pole adjacent the Hall effect sensor unit, the said poles adjacent the Hall effect sensor unit being of opposite polarity.

Conveniently the or each magnet is a NdFeB magnet.

Preferably the spacing between the magnets is equivalent to the distance moved by the magnet housing as the latch-plate moves from the latching position to the release position.

Advantageously the said arm forms part of a magnet support element which is snap-fitted to the latch-plate.

Preferably the magnet support element is formed as a plastics material moulding comprising a support plate provided with resilient protuberances to enable the snap-fitting to the latch-plate, the arm being a cranked arm extending to a position adjacent a side-wall of the channel, the termination of the cranked arm carrying a magnet housing which carries the or each said magnet.

Conveniently the Hall effect sensor unit comprises a housing, the housing being provided with protruding elements to be snap-fitted to parts of a side-wall of the channel.

Preferably the housing of the Hall effect sensor unit is provided with a protruding buttress which, in one position of the buckle, serves to retain the magnet housing in an appropriate position.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is an exploded view of the major operative parts of a seat-belt buckle,

FIGURE 2 is a perspective view of components to be mounted on the buckle of Figure 1, comprising a magnet support element, an anti-rattle spring, and a Hall effect sensor and its associated housing, the sensor and housing being shown in an exploded configuration,

FIGURE 3 is a view corresponding to Figure 1 illustrating a complete buckle comprising the components shown in Figure 1 and the components shown in Figure 2,

FIGURE 4 is a top plan view of the buckle of Figure 3 illustrating the buckle before a tongue has been retained in position within the buckle,

FIGURE 5 is a side view of the buckle of Figure 4,

FIGURE 6 is a view corresponding to Figure 5 illustrating the buckle when a tongue has been inserted into the buckle.

A buckle of this general type, provided with a micro-switch sensor, is shown in DE-A-4,338,485. This particular buckle has been selected for the purpose of explaining the present invention, but the invention may be embodied in many different types of buckle.

The invention will be described with reference to a particular form of buckle, namely a buckle as sold by Autoliv AB of Sweden, and having their reference of K12. This buckle is in wide use at the present time.

Referring to Figure 1, the buckle includes, within an appropriate housing (not shown), a generally "U"-shaped channel 1 formed from a metal pressing. The channel defines a flat base 2 having an aperture 3 by means of which the channel may be connected, by a rivet or the like, to one end of the metal strap, the other end of which may be connected to an anchoring point provided in the vehicle.

The channel is provided with two upstanding side-walls 4, 5, which are provided with various cut-out apertures.

At one end of the channel, adjacent the aperture 3, the side-wall 4 defines, at its upper edge, a cut-out 6, and the side-wall 6 defines a similar cut-out 7. These cut-outs are adapted to receive lugs provide on a latch member, so that the latch member may be pivotally connected to the channel. In the central

region of the channel there is a guide slot 8 formed in the base 2 of the channel, and the regions where the base 2 of the channel merges into the side-walls 4, 5, is cut-away to form elongate slots 9, 10. The guide slot 8 and the elongate slots 9, 10, receive parts of a slider member.

At a position above the ends of the slots 9, 10, adjacent the other end of the channel, remote from the aperture 3, the side-wall 4 of the channel defines a generally "L"-shaped slot 11, and the side-wall 5 is provided with an equivalent "L"-shaped slot 12. The "L"-shaped slots each have a horizontal base portion directed towards the end of the channel remote from the aperture 3 and a vertical portion. The slots 11 and 12 are to receive a transverse rod.

The forward-most part of the side-wall 4 defines a further slot 13 and a corresponding slot 14 that is defined by the upstanding side-wall 4. These slots are to receive part of an actuating button.

The vertical edge of the side-wall of said one end defines a recess 15, and the upper part of the side-wall has a projection 16 spaced from the said one end. The importance of the recess and projection, in this embodiment, will become clear from the following description.

A latch-plate 20 is provided which is to be mounted to the channel At one end, the latch-plate 20 defines two laterally outwardly extending lugs 21, 22, which are dimensioned to be received within the cut-outs 6 and 7 provided in the side-walls of the channel, so that the latch-plate may be pivotally connected to the channel. The latch-plate has a large rectangular central aperture 23, one edge of which is provided with an axial lug 24 which protrudes into the aperture. The lug serves to mount one end of a helical spring 25 to the latch-plate. The edge of the latch-plate positioned furthest from the laterally

outwardly extending lugs 21 and 22 is provided with a centrally located downwardly deflected finger 26. This finger, when the tongue has been inserted into the latch, will pass through an aperture in the tongue, and also through part of the guide slot 8 formed in the base 2 of the channel in order to retain the tongue in position within the channel.

A slideable member 30 is provided having laterally extending wings 31, 32, which wings are adapted to be received within the cut-outs 9, 10 formed between the base 2 and upstanding side-walls 4, 5 of the channel.

The slider member 30 supports a cantilevered rocker element 33. The rocker 33 engages the end of the spring 25 remote from the axial lug 24.

A cylindrical rod 35 is provided adapted to be located in position extending through the co-aligned "L"-shaped slots 11 and 12. The rod is larger than the width of the channel so that the ends of the rod protrude beyond the side-walls of the channel.

An actuator button 40 is provided adapted to be mounted on the forward-most part of the channel 2, for sliding movement along the channel.

When the buckle is in an initial or unlatched position, the latch-plate 20 is in an elevated position, and the rod 35 is at the upper-most part of the vertical portion of the "L"-shaped slots 11 and 12. The slider 30 is in a forward-most position, being biased forwardly by the spring 25, with part of the slider being located beneath the lower-most end of the depending finger 26 provided on the latch-plate. As the tongue of a safety-belt is inserted into the buckle, from a position in front of the actuator button 40, the slider moves away from the actuator button 40, and the spring becomes compressed. The latch-plate 20

pivots downwardly and the depending finger 26 passes through an aperture formed in the tongue. The rod 35 moves to a position at the forward-most end of the horizontal part of each "L"-shaped aperture 12, lying above part of the latch-plate 20 to retain the latch in the latched condition.

When the actuating button 40 is pressed inwardly, the slider 30 moves further along the channel against a bias provided by the spring 25, and part of the slider engages the ends of the rod 35 to move the rod back to its initial position, thus permitting the latch-plate 20 to rise, releasing the tongue and permitting the tongue to be ejected from the buckle.

As mentioned above, this type of buckle is conventional and well known in the art.

Referring now to Figure 2, the components of a sensor to be incorporated in the buckle is shown. A first component is a magnet support element 50. The magnet support element 50 may be moulded integrally of a plastics material, and is adapted to be fastened to the latch-plate 20 so as to move with the latch-plate 20. The magnet support element 50 is designed to be snap-fitted to a conventional latch 20, thus obviating the need to modify the design of the present buckle.

The magnet support element 50 comprises a plate 51 provided with depending snap-acting lugs 52, 53, 54, by means of which the plate 51 may be snap-fastened to the planar end region of the latch-plate 20 which defines the laterally protruding lugs 21, 22.

Extending from one part of the plate 51 is a cranked support arm 55 which terminates, at its free end, with a magnet housing 56. The magnet

housing 56 is dimensioned to accommodate two cylindrical magnets 57, 58, the magnets lying adjacent each other with the axes of the magnets being parallel. The magnets are NdFeB magnets, which are magnets of substantial strength.

An anti-rattle spring 60 is associated with the magnet support element 50. The anti-rattle spring 50 is provided with a central portion 61 adapted to engage the upper part of the plate 51, and two diverging arms 62, 63, each adapted to engage part of the channel. The spring is intended to provide a gentle downward bias to the plate 50 in order to minimise any risk of the latch-plate 20 moving or "rattling" within the housing.

A Hall sensor unit 70 is provided, the sensor unit 70 comprising a housing 71 which may be moulded from an appropriate plastics material. The housing 71 has an upwardly directed arm 72 carrying a transversely extending finger 73 which terminates with a forwardly directed lug 74. The finger 73 and lug 74 are adapted to embrace the upstanding projection 16 provided on the side-wall 4 of the channel 2.

One end of the housing 21 is provided with a transversely extending mounting plate 76 provided with a snap-acting finger 77, adapted to co-operatingly engage with the recess 15 provided at one end of the side-wall 4. Thus the housing 71 may be snap-mounted in position on the channel without effecting any design changes to the channel. The housing is provided with a projecting buttress 78 on its exterior wall, that is the wall that faces away from the channel which serves as a locating buttress for the magnet housing 56. The housing 71 is hollow, and has a separate backing plate 79 which may be fastened to the housing in a convenient manner. The housing contains a Hall effect sensor circuit 80.

The Hall effect sensor circuit 80 is a bi-polar Hall effect sensor, which is to say that the Hall effect sensor is sensitive to, and can distinguish between, the flux provided by a North pole and the flux provided by a South pole, and can provide output signals of opposite polarity depending upon the nature of the magnetic flux detected.

Figure 3 is an exploded view showing how the magnet support element 50 and the sensor unit 70 are to be mounted to the other components of the buckle. The spring 60 engages the projection 16, and a corresponding projection on the side-wall 3.

Figures 4, 5 and 6 show the buckle in the fully assembled state.

Referring initially to Figures 4 and 5 which show the components of the buckle when the buckle is in the unlatched state, it can be seen that the cranked arm 55 has a first portion which extends across the top of the side-wall 4 and an elongate second portion which extends parallel with the side-wall 4, and supports the magnet housing 60 at a position adjacent the outside edge of the housing 71. It is to be appreciated that when the base 2 of the channel is horizontal, and the latch moves with its pivotal action about the axes defined by the lugs 21, 22, as retained in the cut-outs 6, 7 provided in the upstanding side-walls 4, 5 of the channel 2, the magnet housing 60 will effect a short arcuate movement which is a substantially vertical movement, that movement being in a plane which is perpendicular to the plane of the base 2 of the channel. The magnet housing will move through a substantial distance as the latch-plate 20 moves between the latching position and the release position, that distance being equivalent to the spacing between the magnets 57, 58.

It is to be understood that when the buckle is in the unlatched condition, as shown in Figure 5, the lower-most magnet 58 within the magnet housing is aligned with the Hall effect sensor circuit 80 as provided within the housing 71. When the buckle is moved to the latched condition, the latch member 20 pivots to become more horizontal, as shown in Figure 6, and the arm 53 moves the magnet housing 56 downwardly so that the upper magnet 57 becomes aligned with the Hall effect sensor circuit 80. The Hall effect sensor circuit thus experiences a very substantial change in magnetic flux density. It is believed that the change in magnetic flux density may be more than 150 mT under ordinary conditions. This compares with figures as low as 6 to 15 mT in alternative designs.

The anti-rattle spring holds the latch in the desired position with a gentle bias, minimising any undesired vibrations in the region of the magnet housing 56. The buttress 78 lies immediately adjacent the magnet housing 56, and may be engaged by the magnet housing 56, or the cranked arm 53 if the latch plate 20 moves in an undesirable manner, thus restricting the possible movement of the magnet 57 when the magnet 57 is aligned with the Hall effect sensor circuit 80.

It is to be appreciated that in the described embodiment of the invention, the magnet support element and the Hall sensor unit are provided as snap-on components which can be snap-fitted to existing components of the buckle, without necessitating any modification of the existing buckle.

In the present Specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following Claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS:

1. A seat-belt buckle incorporating a sensor to detect the presence or absence of a tongue retained within the buckle, the buckle comprising a channel having a base and upstanding side-walls, and a latch-plate mounted for pivotal movement relative to the channel between a latching position and a release position, the latch-plate carrying an arm which extends laterally beyond one side-wall of the channel, and which carries a magnet housing containing at least one magnet, the channel being provided with a Hall effect sensor unit located adjacent the said side-wall, the arrangement being such that the magnet moves relative to the Hall effect sensor as the latch moves from the latching position to the release position.

2. A buckle according to Claim 1 wherein the magnet housing contains two magnets, the magnets being located adjacent each other and each having one pole adjacent the Hall effect sensor unit, the said poles adjacent the Hall effect sensor unit being of opposite polarity.

3. A buckle according to Claim 1 or Claim 2 wherein the or each magnet is a NdFeB magnet.

4. A buckle according to Claim 2 or 3 wherein the spacing between the magnets is equivalent to the distance moved by the magnet housing as the latch-plate moves from the latching position to the release position.

5. A buckle according to any one of the proceeding Claims wherein the said arm forms part of a magnet support element which is snap-fitted to the latch-plate.

6. A buckle according to Claim 5 wherein the magnet support element is formed as a plastics material moulding comprising a support plate provided with resilient protuberances to enable the snap-fitting to the latch-plate, the arm being a cranked arm extending to a position adjacent a side-wall of the channel, the termination of the cranked arm carrying a magnet housing which carries the or each said magnet.

7. A buckle according to any one of the proceeding Claims wherein the Hall effect sensor unit comprises a housing, the housing being provided with protruding elements to be snap-fitted to parts of a side-wall of the channel.

8. A buckle according to Claim 7, wherein the housing of the Hall effect sensor unit is provided with a protruding buttress which, in one position of the buckle, serves to retain the magnet housing in an appropriate position.

9. A seat-belt buckle substantially as herein described with reference to and as shown in Figures 2 to 6 of the accompanying drawings.

10. Any novel feature or combination of features disclosed herein.

Application No: GB 0204124.2
Claims searched: 1-9

Examiner: A J Rudge
Date of search: 28 June 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): E2A(AARB, AAE)

Int Cl (Ed.7): A44B11/26, B60R 22/00, B60R 22/48

Other: Online databases: EPODOC, JAPIO, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	WO 02/06092 A1 (DELPHI TECHNOLOGIES) - eg claim 1	1 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.